

## CLAIMS

1. A non-thermal plasma reactor, comprising:
  - a plasma-generating substrate having one or more flow paths for an exhaust gas;
  - a housing having an inlet and an outlet;
  - 5 a mat retaining said plasma-generating substrate in said housing such that said one or more flow paths are in fluid communication with said inlet and said outlet;
  - a voltage supplied to said plasma-generating substrate for generating a plasma field; and
  - 10 an electrically insulating layer disposed between said plasma-generating substrate and said housing for preventing an arc of electricity from said plasma-generating substrate and/or said voltage to said housing.
2. The non-thermal plasma reactor of claim 1, further comprising a retaining device for diffusing said exhaust gas to said plasma-generating substrate and away from said mat.
3. The non-thermal plasma reactor of claim 1, wherein said retaining device distributes a low retention force of said mat to a weak side of said plasma-generating substrate, and an high retention force of said mat to a medium strength area and a high strength area of said plasma-generating  
5 substrate.
4. The non-thermal plasma reactor of claim 3, wherein said low retention force compresses said mat to a density of less than 0.3gm/cc and said high retention force compress said mat to a density of more than 0.3gm/cc.



13. A non-thermal plasma reactor, comprising:
- a plasma-generating substrate having one or more flow paths for an exhaust gas;
  - a housing having an inlet and an outlet;
  - 5 a mat retaining said plasma-generating substrate in said housing such that said one or more flow paths are in fluid communication with said inlet and said outlet;
  - a voltage supplied to said plasma-generating substrate for generating a plasma field; and
  - 10 a retaining device for diffusing said exhaust gas to said plasma-generating substrate and away from said mat.

14. The non-thermal plasma reactor of claim 13, further comprising an electrically insulating layer disposed between said plasma-generating substrate and said housing for preventing an arc of electricity from said plasma-generating substrate and/or said voltage to said housing.

15. The non-thermal plasma reactor of claim 13, wherein said retaining device distributes a low retention force of said mat to a weak side of said plasma-generating substrate, and a high retention force of said mat to a medium strength area and a high strength area of said plasma-generating
- 5 substrate.

16. The non-thermal plasma reactor of claim 15, wherein said low retention force compresses said mat to a density of less than 0.3gm/cc and said high retention force compress said mat to a density of more than 0.3gm/cc.

17. The non-thermal plasma reactor of claim 13, wherein said insulating layer is a mica layer.

18. The non-thermal plasma reactor of claim 13, wherein said retaining device is an enhanced diffusion header of said inlet and said outlet in close proximity to said one or more flow paths.

19. The non-thermal plasma reactor of claim 13, wherein said retaining device is formed by said inlet and said outlet being in close proximity to said one or more flow paths.

20. The non-thermal plasma reactor of claim 13, wherein said plasma-generating substrate includes peripheral extensions forming said retaining device.

21. A method of forming a non-thermal plasma reactor, comprising:

providing a plasma-generating substrate having one or more flow paths for an exhaust gas;

5 disposing said plasma-generating substrate in a housing having an inlet and an outlet such that said one or more flow paths are in fluid communication with said inlet and said outlet;

retaining said plasma-generating substrate in said housing with a mat and a retaining device; and

10 supplying a voltage to said plasma-generating substrate for generating a plasma field,

wherein said retaining device diffuses said exhaust gas to said plasma-generating substrate and away from said mat, distributes a low retention force of said mat to a weak side of said plasma-generating substrate,  
15 and distributes an high retention force of said mat to a medium strength area and a high strength area of said plasma-generating substrate.

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22. The method of forming a non-thermal plasma reactor of claim 21, further comprising providing an electrically insulating layer between said plasma-generating substrate and said housing for preventing an arc of electricity from said plasma-generating substrate and/or said voltage to said housing.

23. The method of forming a non-thermal plasma reactor of claim 21, wherein said low retention force compresses said mat to a density of less than 0.3gm/cc and said high retention force compress said mat to a density of more than 0.3gm/cc.

24. The method of forming a non-thermal plasma reactor of claim 21, wherein said insulating layer is a mica layer.

25. The method of forming a non-thermal plasma reactor of claim 21, wherein said retaining device is an enhanced diffusion header of said inlet and said outlet in close proximity to said one or more flow paths.

26. The method of forming a non-thermal plasma reactor of claim 21, further comprising forming said retaining device by positioning said inlet and said outlet in close proximity to said one or more flow paths.

27. The method of forming a non-thermal plasma reactor of claim 21, further comprising providing peripheral extensions on said plasma-generating substrate in close proximity to said inlet and said outlet.

28. The method of forming a non-thermal plasma reactor of claim 21, further comprising providing a sealant on said mat at least at an interface of said retaining device and said plasma-generating substrate.

29. The method of forming a non-thermal plasma reactor of claim 21, further comprising:

compressing said mat to a high density between said retaining device and said inlet opening and said outlet opening.

30. The method of forming a non-thermal plasma reactor of claim 21, further comprising:

placing a rigid insulation board proximate said weak side of  
said plasma-generating substrate prior to disposing said plasma-generating

5 substrate in said housing,

retaining said plasma-generating substrate in said housing compressing said mat with said rigid insulation board to form a seal.